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THE NEW THEORY OF TIDAL EVOLUTION.

THERE are few persons who have not been occasionally at the seaside, and watched the tides. Every twelve hours the water of the ocean advances towards the shore with slow and measured pulsations; and no sooner does it approach high-water mark, than it slackens, stops, and then begins to recede in the same gradual and regular manner. From day to day, and year to year, this constant ebb and flow is going on, till the 'tide' has become, equally with 'time,' the symbol of uncontrollable and unhesitating movement. Most people also know that these tides are in some way or other dependent on the moon—that they are in some way regulated by the moon's relation to the earth. Yet, although the general principle of this theory is obvious and determined, various questions arising out of it have continued to puzzle alike the astronomer and the physicist; and the investigation of these questions has led to what is known as the Theory of Tidal Evolution, the discoverer of which is Mr G. H. Darwin, Fellow of Trinity College, Cambridge, and eldest son of Charles Darwin, whose name may be said to stand first in the ranks of science in the nineteenth century.

For the materials by means of which we propose to explain this new and wonderful discovery to our readers, we are indebted to a lecture delivered in October last at the Midland Institute, Birmingham, by Robert J. Ball, Andrews Professor of Astronomy in the University of Dublin, and Royal Astronomer of Ireland. Professor Ball, like his contemporaries Professors Huxley and Tyndall, possesses in a marked degree that valuable combination of literary skill and scientific precision which renders their expositions of great principles as luminous and interesting to the non-scientific as to the scientific reader.

In dealing with a subject of this kind, time must be measured neither by centuries nor millenniums. Thousands of years are not sufficient to give expression to the dates required, nor tens of thousands, nor hundreds of thousands; the course of geological time is to be reckoned by millions of years. Retrospectively, therefore, we must pass over a period of time which cannot be less than fifty millions of years. About that time it is supposed the chief controlling power in the tidal movements of our ocean came into existence—the earth assumed 'the dignity of maternity,' and its first-born was the moon. 'At the time of the moon's birth, the earth was not as we see it now, clothed with vegetation and teeming with animal life. It was a huge inorganic mass, too hot for life, perhaps hot enough to be soft or viscid, if not actually molten. The offspring was what might be expected from such a parent. It also was a rude inorganic mass. Time has wrought wondrous changes in both parent and child. Time has transformed the earth into an abode of organic life. It has transformed the earth's offspring into our silvery moon.'

But how, it may be asked, was this birth brought about? The answer, while rigidly based on legitimate scientific induction, is poetical enough to be worthy of the finest imaginations amongst the poets of ancient Greece or Rome. Fifty million years ago the earth, as already remarked, was not as we see it now. At the critical epoch of the moon's birth, the length of the day was only a very few hours—something more than two and less than four. If we call it three hours, Professor Ball thinks we shall not be far from the truth. The mathematician finds that it could not have been—never at any time could have been—much less than three hours; because, if the rotation of the earth on its axis exceeded a certain speed, the equatorial portions of the globe could no longer cling together. 'It can be shown that the rotation of the earth when on the point of rupture corresponds to a length of the day somewhere about the critical value of three hours; it is therefore impossible for us to suppose a day much shorter.' Hence, while the earth was rotating at this enormous speed—namely, once in three hours instead of once in twenty-four—it must have been strongly

predisposed to rupture; and a cause tending to precipitate such a rupture, or throwing-off, was then ready to hand. This was the power of attraction by which the sun, as well as the moon, produces tides in the earth, though these solar tides are very small as compared with the lunar ones. The sun, however, does exercise such a power; and there being at that time no moon, and hence no lunar tides, the throbs, or pulsations, or bulgings, which the solar influence produced in the soft or molten body of the earth—for tides do not require oceans, or even water, for their operation—was not unlikely the occasion by which the moon was fractured off from the earth and assumed the dignity of an independent body. It was thus the moon was born; and it is at this point that its life-history begins.

The fragment in this way torn off from the earth, being a soft and yielding mass like that of the earth itself, would not long retain the ragged corners and irregular shape which it probably at the first had. The mutual attraction of its particles would draw the mass together, till it gradually assumed the beautiful globular form which we now see. 'By the same gentle ministrations the wound of the earth would soon be healed. In the lapse of time the earth would become as whole as ever, and at last it would not retain even a scar to testify to the mighty catastrophe.'

But though the earth and the moon thus became separate existences, they did not fly to a great distance apart. The child continued metaphorically to cling to its mother. At the commencement of this epoch the two globes were quite close; they were revolving rapidly, and the moon was constantly over the same locality on the primeval earth—no doubt somewhere near the equator. Around the primeval earth the moon revolved in three hours; the earth also revolved in three hours; and thus their relative positions remained unchanged. They were for the time in a state of unstable equilibrium. But this could not last. 'Either the moon must fall back again on the earth and be reabsorbed into its mass, or the moon must commence to move away from the earth. Which of the two courses was the moon to take? The case is analogous to that of a needle balanced on its point. The needle must fall some way, but what is to decide whether it shall fall to the right or to the left? We do not know what decided the moon, but what the decision was is perfectly plain. The fact that the moon exists shows that it did not return to the earth, but that the moon adopted the other course, and commenced its outward journey.'

It is upon this fact, that the moon *is* constantly though slowly receding from the earth, that all this superstructure of reasonable inference and speculation is based. Once ascertain the fact of this recession and its rate of movement, and the rest is simply a matter of calculation. As is well known, any body moving in a circle has a constant tendency to proceed in a straight line, or fly off at a tangent, unless withheld by a force pulling it towards its centre; and this constant tendency to fly off had, in the case of the moon, the effect of gradually enlarging its orbit—that is, the path, so to speak, along which it travels round the earth. Hence, after its separate existence had been effected, the moon began to remove slowly but regularly to a greater distance from the earth. In the course of this movement two things happened. The first was, that the moon as it receded, and kept continually enlarging its orbit, took more and more time to accomplish its circuit round the earth, thus bringing the original equality of revolution between the two bodies to an end. The second result was, that the effect of the moon's attraction on the earth, as exemplified in the tidal movements of the latter, had the effect of retarding the rotation of the earth; just as a piece of wood held firmly against a revolving wheel will in course of time bring it to a standstill, if fresh energy be not infused into the wheel to replace that which is withdrawn by the friction of the piece of wood. In other words, the tides are caused by the moon; the work done by the tides withdraws energy from the earth; and the energy thus extracted is never restored. The immediate consequence, then, of this lunar friction or withdrawal of energy, was to retard the progress of the earth, whereby the rate of its rotation on its axis is constantly diminishing. We thus arrive at the first great result of lunar interference: '*The tides are increasing the length of the day.*'

From this simple fact the great theory of tidal evolution is deduced. 'At present no doubt the effect of the tides in changing the length of the day is very small. A day now is not appreciably longer than a day a hundred years ago. Even in a thousand years the change in the length of the day is only a fraction of a second. But the importance arises from the fact that the change, slow though it is, lies always in one direction. The day is continually increasing. In millions of years the accumulated effect becomes not only appreciable but even of startling magnitude.' And the change in the length of the day must involve a corresponding change in the motion of the moon. 'If the moon acts on the earth and retards the rotation of the earth, so, conversely, does the earth react upon the moon. The earth is tormented by the moon, so it strives to drive away its persecutor. At present the moon revolves round the earth at a distance of about two hundred and forty thousand miles. The reaction of the earth tends to increase that distance, and to force the moon to revolve in an orbit which is continually getting larger and larger.'

Thus, then, as the moon receded, the period which it required for its journey round the earth increased also, till that period, which initially was but three hours, has increased to our present month of six hundred and fifty-six hours. At the same time that the earth's rotation on its axis is getting slower, so is that of the moon, but the retardation of the moon is much greater than that of the earth.

The moon continuing to recede further and further from the time of its first revolution about the earth, 'at length,' continues Professor Ball, 'a noticeable epoch was reached, to which I must call attention. At that epoch the moon was so far out, that its revolution took twenty-nine times as long as the rotation of the earth. The month

was then twenty-nine times the day. The duration of the day was less than the present twenty-four hours, but I do not believe it was very much less. The time we are speaking of is not very remote, perhaps only a very few million years ago. The month was then in the zenith of its glory. The month was never twenty-nine times as long as the day, before. It has never been twenty-nine times as long as the day, since. It will never be twenty-nine times as long as the day, again.'

This maximum length of month could not long, in the nature of things, continue; the ratio of the day to the month was still undergoing a change. As the velocity of the earth abated, and the length of the day was correspondingly increased, it by-and-by came to revolve only twenty-eight instead of twenty-nine times during one revolution of the moon around it; till now, in our time, it only makes twenty-seven rotations in one revolution of the moon. 'This has remained sensibly true for thousands of years, and no doubt will remain sensibly true for thousands of years to come; but it will not remain true indefinitely. Wondrous as are the changes which have occurred in times past, not less wondrous are the changes which are to occur. Further and further will the moon retreat, and more and more slowly will the earth revolve. In the dim future, many millions of years distant, the final stage will be approached. As this stage draws nigh, the rotation of the earth will again approach to equality with the revolution of the moon. From the present month of twenty-seven days, we shall pass to a month of twenty-six days, of twenty-five days, and so on until eventually we shall reach a month of two days, and lastly a month of one day. When this state has been attained, the earth will constantly turn the same region towards the moon.

'Here you see that the first state and the last state of the earth-moon history are in one sense identical. In each case the same face of the earth is constantly directed towards the moon. In another way, how different are the first stage and the last. At the beginning the day and the month were both equal, and they were each *three hours*. At the end the day and the month will be again equal, but they will each be *fourteen hundred hours*. The moon will then go round the earth in fourteen hundred hours, while the earth will rotate on its axis in the same time. In other words, the day is destined in the very remote future to become as long as fifty-seven of our days. This epoch will assuredly come if the universe lasts long enough. When it has come it will endure for countless ages. It would endure for ever if the earth and moon could be isolated from all external interference.'

There is only one way, as the Professor humorously remarks, by which this otherwise inevitable result can be avoided. It is by anchoring the moon, and keeping it from going out. 'If you can do this, and if you can also provide a brake by which the speed of the moon can be controlled, then you will be able for ever to revel in the enjoyment of a twenty-four-hour day. Should this engineering feat never be accomplished, then we have only the fourteen-hundred-hour day to look forward to.'

Stated in this abrupt way, the outlook is such as to take us by surprise. But, the Professor reminds us, there is nothing untoward in the prospect when we take natural selection as our comforter. By natural selection man has become exactly harmonised with his present environment; and as the day lengthens, so will man's nature gradually change too, without any hardship or inconvenience. It seems no hardship that our children should have a day of one second and twenty-four hours instead of twenty-four hours; our grandchildren a day a second longer than the day of our children; our great-grandchildren a second longer still, and so on continually. No one except the astronomers would be able to detect the change, and daily life would be unaltered. Yet, carry on this process for *a hundred and fifty million years*, and we shall find that the whole change of the day from twenty-four hours to fourteen hundred hours has been accomplished. 'The actual rate of change is much less than this, and is at present so small that astronomers can hardly even detect it.' When, however, this remote period, with its day and night of seven hundred hours each, is reached, as reached it will be, the solar tides will again intervene, as we found they intervened previous to the birth of the moon. They will have little effect upon the moon; it will revolve as before; but they will begin to retard the progress of the earth still further. Instead of a period of fourteen hundred hours, the earth will have a still longer day, so that, finally, the moon will revolve more rapidly around the earth than the earth will rotate on its axis.

All these surprising and momentous changes in the future will be due to tidal influences. But let us revert for a little to the past, and see what the effect of these tidal influences has been during the millions of years of geological time.

Ramsay, Lyell, and their school of geologists have been content to believe that the external agencies which are at present gradually changing and modifying the earth's surface, are sufficient, if they be given time enough, to account for all the changes that have taken place in the earth's surface or crust during the geological periods of the past. But the mathematicians and physicists would not give them time enough, and they ordered the geologists to 'hurry up their phenomena.' But here, in this latest theory of tidal evolution, we have a new and stupendous power introduced, of which the geologist has hitherto had no conception. The height and force of the tides at the present time, varying from a few inches in some localities to sixty or seventy feet in others, are as nothing compared with what they must have been when the moon was one-fourth or one-sixth nearer the earth than it is now. The moon is at present two hundred and forty thousand miles distant from the earth; but there was a time when it was only forty thousand miles away. The efficiency of the moon in producing tides varies inversely as the cube of its distance. Taking the low average of three feet as the height of our tides all over the globe, under our two-hundred-and-forty-thousand-mile moon, Professor Ball calculates rightly that the forty-thousand-mile moon, being at a distance of only one-sixth of our present moon, would have its tidal influence increased two hundred and sixteen times. That is, instead of the three-feet rise and three-feet fall of our present tides, we would have these ancient tides rising and falling a height of *six hundred and forty-eight feet*. Take into consideration with this, that the

earth at that time made a complete rotation on its axis in perhaps from four to six hours, and we have the movement of this tremendous mass of water rushing to and fro upon the surface of the earth, grinding down its rocks and scooping out its valleys, with a velocity and a power of which we can have but the very faintest conception.

'These mighty tides,' says Professor Ball, 'are the gift which astronomers have now made to the working machinery of the geologist. They constitute an engine of terrific power to aid in the great work of geology. What would the puny efforts of water in other ways accomplish, when compared with these majestic tides and the great currents they produce? With this new and stupendous tidal grinding-engine, the geologists can get through their work in a reasonable period of time, and the geologists and the mathematicians may be reconciled.'

In all the difficulties that have hitherto surrounded the geologist in relation to the immense marine deposits of the past, and which now form the principal rocks in the earth's crust, this new theory of tidal evolution may operate as a most important factor, introducing as it does a denuding agent of tremendous power, before which all similar existing agencies dwindle down into mere nothingness. Should the doctrine be found to be as irrefragable as Professor Ball considers it to be, the nineteenth century will have added to its great scientific achievement of Natural Selection the equally wonderful theory of Tidal Evolution.

THE COUNTER-SYNDICATE.

CHAPTER IV.—THE RECKONING-DAY.

THE departure of Mr Quick roused the partners from the crushing feebleness his presence and words had caused. Mr Naylum was the first to show symptoms of returning energy. He rose to his feet, then walked to the window looking into the street. The sight of busy people hurrying along; the sharp rattle of a cab dashing past; and the occasional rumble of heavy railway-vans passing the end of the street, gradually brought his mind nearer to its ordinary focus. Mr Quick ceased to occupy the whole field of his mental vision, as these external objects and sounds resumed authority over Mr Naylum's consciousness. That quiet tyranny of the commonplace, to which we are subject for the greater part of our lives, gives a steadiness to excited brains beyond any other anodyne. Mr Naylum grew calm as the familiars of his daily surroundings greeted him in their wonted guise once more. Alarm began to subside, and a revulsion of feeling soon followed.

This grew apace, and at length he was able to unlock the cupboard, where he kept a bottle of choice sherry, which he took with his midday sandwich. He drank a couple of glasses with eagerness. Soon the rebound came; his face assumed something of its usual ruddiness; his hand no longer trembled; his head grew erect.

'Come, Fox,' he said, filling a glass and presenting it to his senior, 'we must not give up in this way.'

Mr Fox was fifteen years older than the junior partner, and was of much feebler physique. He would need a considerable interval to reach his ordinary mental altitude. He drank the wine, however, as did Mr Smiles also; and in half an hour, business acquaintances would not have detected any striking change in the behaviour or demeanour of the partners.

After a desultory talk, interrupted by spasms of recurring fear, the perilous situation of things was discussed with as much coolness as racked nerves allowed. The native hardihood of Mr Naylum and his predominating animal force began to control his less resolute friends. A fourth glass of sherry heated his blood to its usual choleric irritability, and he felt equal to fighting Quick and the rest of his enemies to the death.

'Are we going to let these fellows do as they please with us?' he demanded, breaking in upon a timorous objection by Mr Fox. 'How do we know that Quick is not as great a liar as he is a traitor? He may have been imposing a heap of fictions upon us after all. Granted that Grosschnabel has cut us adrift, granted Sharfsinn and Geldmacher have betrayed us, how do we know that everything else is as black as Quick paints it? I am for fighting to the last.'

'I do not think that Quick *is* a liar,' said Mr Fox after a short reflection. 'He is in too strong a position to need the aid of falsehoods, and his nature is hard and stubborn. Weak, shifty, unfortunate men tell lies; bold men can get on without them. No; Quick has told the truth, I fear.'

'Whatever he has told,' interposed Mr Smiles decisively, 'we must not forget that he is our proclaimed adversary. Naylum is right; we must defend ourselves without delay.'

'Well, what do you propose, Naylum?' asked Mr Fox with fretful submissiveness.

'What do I propose? This. I shall go first to Grosschnabel, and learn, as far as I can, the extent of his committal to the "bulls."—You, Smiles, must go to Paris as soon as possible, and learn on the spot what is the worst we have to expect from De Predateur.—You, Fox, must hunt up every vestige of influence we possess in the City, and stick at nothing that promises help. The rise in silk, on which such great results depend, is most encouraging. If we can hold on for a fortnight, we may pull through, even if all be as bad as Quick asserts.—After seeing Grosschnabel, I shall start for Hamburg, to investigate the doings of Sharfsinn and Co. with my own eyes. Let us remember those people have other commissions of ours in hand; and if they have checkmated us in this cursed coffee business, they will not hesitate to damage us further. Our only chance of safety lies in action, swift, deliberate, courageous action. If we succeed, I will spend twenty thousand to punish that scoundrel Quick. If I ever get him into my power, I will crush him down again into the mud from which we raised him, and beyond hope of rising again.—Come Fox,' he cried vehemently,

'for heaven's sake, pluck up some spirit! Be a man! All is not lost yet, because a number of wolfish traitors have joined to compass our ruin. Are you going to be dragged down into the abominations of poverty and disgrace, without striking a blow at your enemies? Come! Do not let us submit like cowards.'

A gleam of bright confidence overspread Mr Smiles's face during his friend's fervid harangue, and it mounted to a commendatory cry at the end.

'Well done, Naylum! You are a faithful partner, in bad luck as in good.—Now, Fox, my very dear friend and fellow-sufferer, pitch away your fears, and do *your* share to retrieve the *faux pas* we have made together. I shall do as Naylum suggests; and shall not leave Paris until I have bottomed the mystery of this defection of our old agents. I will wire you as things develop. Of course I shall use our private code, though, by the way, I must make some alterations in it, now that Quick is against us. However, you will have the key. In the midst of such treason as now prevails, I can trust nobody but ourselves. That German Steinherz is a new figure in London finance; but I shall learn from old Haquin of the Rue Freydeau all about him; if he is known in Paris.—Now, Fox, my dear fellow, cheer up. You are indispensable for the general success. Here you will remain in the citadel, when Naylum and I are fighting outside; if you fail to defend our common interests, all our work will be fruitless. *Allons!*'

A wintry smile was the only response. But noting that Naylum was going to explode, and that Smiles, usually bland under all provocations, was red with passion, Mr Fox, by a great effort exclaimed: 'Be sure I shall not be wanting in what is my duty. I need no urging to look after the great stake I have in this house.'

'But, Fox, at anyrate pray put on a different look. If you go out with that expression, everybody will read disaster in your face.' Mr Smiles again relapsed into his winning style. 'What we want now is to inspire confidence into friends, and dread into foes. Bold looks and high-toned voices are simply worth thousands to us at this moment. Think only of the winning side; for we *may* win still. And take another glass of wine.'

'Yes, take another glass, Fox,' added Naylum eagerly; 'you know I only drink the best. I find a pint of this Amontillado the finest tonic in the world. And for the time this bothering trouble lasts, do justice to your own excellent port. Likewise eat more than you usually do. In short, charge the digestive magazine with all the combustibles and ordnance needed for the battle now commencing; a battle for dear life, for fortune, for *revenge!* Revenge! Fox, think of that. Sweet revenge upon those who are glorying in your expected downfall.—Here, Smiles; take another glass yourself; and I will drink a last to the eternal confusion of Quick, Grosschnabel, and all other scoundrels who are arrayed against the house of Fox, Smiles, and Naylum.'

'Bravo! Naylum,' cried Smiles, slapping his partner's broad back. 'You are a rare yoke-fellow. No, no; we are not children, terrified with any one who cries "Boo!" We have missed fire before to-day, Fox. Do you forget that Bombay hemp affair, how ugly it was? But the rise in Cape-wool squared that difficulty, big as it was, and left us a cheerful margin. Again, I say, almost solemnly, Fox,' and here Mr Smiles became singularly grave—somehow early sherry, to which he was not accustomed, seemed to have an abrupt depressing influence—'I say solemnly, Fox, look cheerful and take a hopeful view. It is madness to meet trouble half way.'

The appeal was not without effect. Mr Fox got up and straightened his relaxed limbs; then he rubbed his chilled fingers before the fading embers of the fire, and sat down again in apparent perfect composure. But his wandering eyes and the indeterminate movement of his hands showed that anxiety was only masked, and that his sympathy was an uncertain emotion.

Both the others looked keenly at him; then furtively at each other, knitting their brows.

'Why, it's twelve o'clock!' exclaimed Mr Naylum, looking at his watch. 'I must catch Grosschnabel before he goes to his bank meeting.—Smiles, just come to my room for a minute. I have some French money; you may as well make use of it.'

The two left Mr Fox to himself.

When they were alone, Naylum said in a hoarse whisper: 'Fox is played out. I dare not trust him.'

'Oh! he will be all right after a while,' returned Smiles, full of confidence once more; 'he always was nervous, you know, and he gets worse as he grows older, I think. Besides, we *must* trust him. He cannot do what we are going to undertake. I'll tell you what, Naylum, we want some young blood brought into the concern. If that wretch Quick had not been so uppish and conceited, he would have been invaluable; but it's always the way with young men nowadays. And what are we going to do with his department? That is another perplexity. Who can take up his work? Naylum, we are hemmed in with difficulties.'

'Pooh!' ejaculated the other disdainfully; 'we must deal with them in detail. We cannot do everything at once. Don't go on like Fox; we must pull together whatever happens. Things must hobble on as best they can for the next few days. I'm not afraid of Fox. He is like a whipped child. If we fail, he will be the cause.' He stood staring at the fire for a moment, then added gloomily: 'Smiles, we do want a young, resolute brain to help us. Yet, do you know, I would rather lose all, than have taken Quick into the firm. I always disliked him, and Fox knows it.' Harassed by fiercely opposing emotions, Messrs Smiles and Naylum went their several ways.

Meanwhile, the senior partner sat rigidly still, resting his head upon his hands and staring at the opposite wall with the remote gaze of complete abstraction. He needed quiet, perfect quiet to gather together thoughts scattered by the scenes of this fateful morning. Facts and feelings told him that the decisive crisis of his life was now at hand. Stupendous changes were coming, which his short remnant of life could not appreciably mitigate. When a man is sixty-five, he is, as a rule, too far advanced to make a new start. Young men, and those like Naylum, in the summer of their strength, might rise from the stormy waters

and struggle to shore; but he felt no power to do so. Besides, Mr Fox had not the fiery aggressiveness of his junior partner; nor had he the plastic susceptibilities of Smiles. He had much self-reliance in extremity; he was sternly selfish too when self was pitted against the world. Although partially stunned, and thrilled by returns of prostrating terror, Mr Quick's most incisive words afforded a growing *point d'appui* round which he could frame a policy to meet *his* emergency. The firm was in direst jeopardy; the supreme question must be personal safety. He was glad Naylum had decided in that way, and that both partners would be absent for a few days. He could use that interval to secure some of his private resources from harm. The idea of allowing his wife and daughters to be stripped of everything was not to be endured. If an utter smash came, well, outsiders must accept a share of its consequences. Self-preservation was the first law of nature.

A smile crept over his weary face as he saw, in his mind's eye, Naylum rushing impetuously to Hamburg. What could he effect there? Would Sharfsinn and Geldmacher become loyal once more under the reproaches and examinations of a stricken man? And what could Smiles extort from such egoistic vultures as De Predateur and Toutœil? Bah! why could his partners not understand that they were irremediably deceived by these astute foreigners, without still more galling evidence! But, let them go. A Titanic blow had fallen upon the house of Fox, Smiles, and Naylum, destroying the bonds which had caused its coherence. The master-fact of the position was—that the firm was practically in dissolution! Whether his associates knew it or not, each now must go upon an *individual* path.

If age had robbed Mr Fox of iron nerves, and if Nature had denied him the swift resilience with which Mr Naylum was gifted, time and temperament now combined to give him the advantage of logical behaviour in the hour of peril. As he grew calmer, he could look beyond the immediate circle of tempestuous personal egoisms into that far more determinate circle of other people's egoisms. The general circumstances of the financial world rose out of the mists with which terror had enwrapped them, the old habit of discounting external probabilities returned. All great speculators are endowed with the far-reaching imagination which enables them to enter into the expectations of others. Mr Fox had this faculty in a larger measure than his partners. He now had a glimpse of the part the world would play when money-markets were quivering with apprehension. This gave new steadiness to his purpose, gradually becoming consistent amid all perturbations and relapses into impotency. Experience had taught him that in the days of mercantile agony the claims of friendship went to the winds; as well beg the stony walls of the Bank to transmute themselves into gold, as implore assistance from suspicious capitalists. If there is a region on earth where *doubt* is but another name for *death*, it is in the haunts of business during a commercial crisis. No form of fear is so terrifically selfish as that of Crœsus trembling for his gold. To save it from harm, he recks not of kindred, of friends, of promises sacred as the grave.

Mr Fox saw himself and partners caught up in the onrushing whirlwind, and hurled into mercantile oblivion, despite all struggles. He could not think longer, but got up hastily and went out.

Mr Naylum's advice to eat and drink copiously of the best, was an impossible regimen for his senior, who was abstemious by nature, and at the present moment quite averse to piquante food. Still, he felt in need of something to stay the faintness coming over him, and went to the old-fashioned hotel he frequented. After a light meal of coffee and biscuits, he proceeded to the nearest cab-stand, and choosing a vehicle with a sprightly horse, he bade the driver take him to Westminster Hall. He wanted to be in motion, swift, distracting, but familiar motion. It took him out of himself, and gave his brain a rest from its own crashings. Then the air began to revive him, and the glare of the shops to interest him, as though he had never seen such things before. He was in a kind of waking sleep when the cab stopped, and he stared in wonderment at Palace Yard. Only for an instant; bidding the man await his return, he entered Westminster Hall as though on urgent business. But he had none whatever. He had sought it for quiet; in the hazard of defining the goal of his drive, Westminster had cropped up, as fifty other places might have done. Parliament was not sitting, and only a few lawyers and members of the public were walking about. Poor Fox paced the Hall automatically for half an hour, and by degrees a gentle languor took the place of the previous disquiet. He went back to the cab, and drove in a wide circuit, round the Park and *viâ* Oxford Street, back to the City.

At five o'clock he was sitting at his desk. Naylum had gone on his way to Hamburg, and Smiles had left to prepare for his journey. At length his mind had settled into something like its usual calm. He wrote for some time in his diary, and all at once a line from one of his school copy-books flashed across his memory, and resolutely remained there. Unconsciously, he wrote it on the paper before him, 'Learn from your enemies.' Then it fascinated him, and he leaned back in his chair muttering: 'Learn from your enemies.' This familiar maxim it was that gave the final direction to thoughts that threatened to become chaotic. The sound of the words brought their significance, and he cried aloud: 'Yes, yes; that is it; I must learn from my enemies.'

After a considerable interval of perfectly sequential thinking, Mr Fox had arrived at this conclusion—that he and his friends were part-causes and part-effects of the excessive mania for speculation for some time at work in the financial world. That world was beguiled with stupendous sophisms, that were summoned to the quick test of validity. Ah! he saw clearly now that it was no local tempest threatening the existence of Fox, Smiles, and Naylum. A general clashing of the financial elements was beginning, in which thousands would be plunged into ruin. Instead of futile struggles to save the firm, he must save himself; Quick, Grosschnabel, all who were ranging themselves on the opposite side, were merely hinting to him to do likewise. It was

not treachery pure and simple that had produced the change in these men; they were too wary, too wise for fickle conduct. 'I see it now,' he groaned; '*they have discounted the reaction.*'

Before going to bed that night, Mr Fox examined the ledger account of his wife's fortune, made up wholly of post-nuptial settlements, and unknown to any one besides himself and Mrs Fox. 'Only thirty thousand pounds,' he said peevishly; 'I must have more than that.'

The next morning, he commissioned his stockbroker to sell fifty thousand pounds consols; the day following, he hurled another mass of securities on the market, and continued a furious 'bear' assault during the week. If the explosion was coming, he would hasten it; and he did.

At length the thunder began to rumble, but the first bolt came out of a very remote part of the financial sky. A cheesemonger of Chester failed to meet a little bill for eighty pounds. It was said he had been speculating in Welsh mines. The falling cheesemonger pulled down the shares of the Cœd-y-pruch copper lode, which gave a vertigo to the directors of the Cymra Bank; which gave a shock to their Manchester alliances; which terrified a financial corporation in London, and made it lessen its balance at the Bank of England; which straightway raised its rate one per cent. Then came the unmistakable crashing all round the heavens. London, Paris, Vienna, Hamburg, New York, gave forth salvos which were replied to by the smaller industrial and commercial cities of Europe and America. The hurricane that blew was so violent, that the most solid of houses quaked, and the less solid of them fell to pieces.

For weeks, the earth was strewed with wreckage of the most dismal sort; for months, a dread solemnity reigned over the domain of money.

Mr Naylum carried the fight to its extreme end; and finding himself surrounded by a ring of fire, fought his final combat with himself, by blowing out his brains, after partaking of a farewell glass of sherry. Mr Smiles rose from the bewildering concussions of his downward flight 'a changed man.' He passed the remnant of his blighted hours as the docile gentleman-of-all-work connected with Mrs Smiles's Establishment for Young Ladies. He meditated much on the *chiaroscuro* of this phantasmal life, and particularly upon the mystery which enabled Mr Fox to retire to the sunny lands of Spain, where he lived in a state of beatific elegance in his orange-bowered villa. How did it come to pass that abysmal ruin had such romantic sequences for Fox, while it had such prosaic sequences for Smiles, and was wholly tragical for Naylum? Poor Smiles never knew that Fox was himself a 'bear' to the last, and that his farewell stroke made ten thousand pounds.

And Mr Quick and his friends the counter-syndicate—what of them? Well, they made an immense haul; for the losses of the many became the gains of the few. The ex-clerk did become a millionaire; but his happiness is still remote, for the deepest fact of social life is—that great wealth and anxiety are inseparable. As an inflexible money-spinner, Mr Quick yet lives envied, adulated, dreaded. Though rich to satiety, yet he cannot leave business, for without its excitement he would either go mad or die. Nemesis has marked him for her own. By financial conspiracy, he rose; and, his illusion is—that by it he is doomed in his turn to fall.

BEDFORD PARK, LONDON.

Bedford Park estate, which has recently been converted into a Limited Liability Company, is at once one of the most novel and most successful of modern experiments in dwelling-house architecture. Victor Hugo has said in one of his novels that 'nothing stifles one like perpetual symmetry. Symmetry,' he goes on to say, 'is *ennui*, and *ennui* is the very essence of grief and melancholy.' Some such idea as this would seem some few years back to have entered the head of one Jonathan Carr, who has since applied it to the hitherto hideous symmetry of London and suburban architecture. Hence the enterprise of Mr Carr, with the aid of his architect Mr Norman Shaw, has resulted in that striking contrast to the rest of the Metropolitan suburbs, which is the subject of this paper. Herein, then, lies the novelty of the scheme; whilst its success, which only half-a-dozen years ago was pooh-poohed as absurd by many who are considered experts in such matters, is sufficiently proved by the fact, that although the number of dwellings on the estate is increasing at the rate of more than one hundred and fifty per annum, yet the demand is still in excess of the supply. As fast as the houses spring up, tenants are found to take them.

Not even in imagination did this charming little colony exist some six years back; in this short space of time it is that the site selected for his experiment by Mr Carr, which then differed in no way from the rest of the surrounding country, has been transformed as though by magic, till the result has equalled the fondest hopes of the founder of Bedford Park. The monotony of green leafage in summer and bare trees in winter, the continuous prospect of fields and orchards, broken only by the still more monotonous rows of brick and stucco houses so familiar to the Londoner wherever the demon builder has set his foot, was then all that met the eye of the railway passenger as he passed Turnham Green or Teddington. But now a change has come over the scene, and the unvarying prospect has been relieved by one bright spot—a single oasis amid the desert of suburban settlements. Mr Carr, the author of this revolution in style, has shown that he possessed the courage necessary to leave the ordinary groove and strike out for himself a new line; and the experiment has met with the success it so well merited. The possessor of about one hundred acres of land near Chiswick, the happy idea occurred to him that the demand for the picturesque in architecture, which has grown with the advance of art in all its branches, might be met by the foundation of a colony on the plan that he has since carried out. He argued that the style hitherto so costly, was so only on account of its exceptional character; and that by building a group, in place of a single house, of the artistic kind above referred to, the objection of expense might be speedily surmounted. And so it has turned out. Enrolling several supporters to his cause, the energetic projector of the scheme was not long before he

effected a start; and within the short space of three or four years the extent of the property has been increased, until more than three hundred houses have been erected—houses as original in design as they are novel and effective in appearance.

One great charm of the idea is that no two of these residences are exactly alike; and the picturesque effect produced by the whole is such as to make the visitor marvel that the idea *is* so novel, and that we have so long been content to inhabit the hideous rows of stuccoed houses which have hitherto prevailed. Moreover, no pains have been spared in the laying out of the estate to preserve the silvan beauty of the scene. Not a tree has been needlessly cut down; so that each dwelling, embowered as it is in its own green garden, is shaded with greenery which would almost lead the uninitiated to suppose that this charming little colony had been in existence for at least as many generations as it has years. The houses themselves vary in size from what may be almost called a family mansion in miniature, down to the cosy little dwelling which brings the idea of 'love in a cottage' from the realms of fancy to those of real possibility; whilst in proportion to their size, the rents range from forty to one hundred pounds per annum, so as to suit a varied class of tenant.

So much for the houses themselves. The estate, which now consists of nearly three hundred acres, is laid out on a plan of equal novelty. Some six or seven streets, or rather winding lanes, are bordered by about three hundred and fifty of these villas—a number which is increasing at the rate above mentioned—cunningly disposed along the lines of street. The peculiar characteristic of these streets is the utter absence of that stiffness which always seems to attend the chilly, regular, and hideous house-rows of our other suburbs. From those straight lines of flat buildings, with their 'long, cold perspectives and gloomy sameness of right angles,' nothing could be further removed than the undulating outlines of the unique little settlement of Bedford Park.

Such are the advantages of this little colony from an architectural point of view; but art alone, it may be objected, cannot provide the necessaries and comforts of life, without which Bedford Park would still be anything but a desirable place of abode. Instead, therefore, of being in any way dependent upon the outside world, this little community is wholly able to supply from its own resources, not only the daily wants and necessities of its inhabitants, but also every social comfort, and even many luxuries. First, there are the co-operative Stores, wherein can be purchased every household requisite. Then there is the 'Club,' containing library, spacious billiard and drawing rooms, lawn-tennis courts both of turf and asphalt, as well as all the usual club privileges. Beyond these, there is a large ball-room, and another intended to be devoted to the histrionic art. This Club, it may be added, is for the use of both sexes, and affords, as it were, a sort of neutral ground for social intercourse; for the 'society' of this little community is its life and essence. Besides all this, there is an Inn at Bedford Park—a kind of antique hostelry—under the sign of 'The Tabard.' Nor, while their creature comforts are thus cared for, have the spiritual wants of the inhabitants been neglected. A church has been consecrated, in keeping with the other buildings, and of a size more than sufficient to meet the growing wants of the little township. Everything, in fact, is to be had, and to be had close at hand, so that it would be practically easy for a whole family, should they wish it, to dwell in Bedford Park, without even wandering beyond the boundaries of their little world.

In point of sanitary economy, Bedford Park maintains its own. The air of the neighbourhood is naturally salubrious. The soil is gravel, and the river flows close at hand. There is a system of drainage on the most approved principles, which has been carried out by the Metropolitan Board of Works under a special arrangement. For the young especially, there is nothing like fresh air, and the neighbourhood of Bedford Park abounds in charming walks. Kew Gardens are but ten minutes' distance by rail, whilst a few minutes suffice to bring the pedestrian to Chiswick. Moreover, though distant only thirty minutes from town, the locality is comparatively free from those fogs which are always so distressing to the Londoner. A visit to this unique suburban township will well repay those who delight in variety of architectural designs combined with pleasant surroundings.

BABU-ENGLISH.

THOSE who have had occasion or opportunity to visit India, and especially those whose lot it has been to spend several years there, know from experience what Babu-English is, and how, in its manipulation, the simplest rudiments of English composition are most innocently ignored. In spite of the numerous Educational Institutions scattered over the land, Babu-English still flourishes in the country; and the specimens which one meets with occasionally are very amusing. A few here, most of which have come under the knowledge of the writer, may not be without interest, and will no doubt cause much amusement to our readers.

The following notes written by a medical officer (!)—a native Hospital Assistant—to his superior, clearly show that, however clever the man may have been in the manipulation of drugs, his concoction of an English sentence, though liberally supplied with words, was far from successful:

'SIR—I beg leave most respectfully to inform your honor that a body is fallen the shore of the river and sinking is died yesterday at the evening time.—Yours obediently, SHAIK HOSSEIN KHAN.'

'SIR—I beg leave to inform your honor that here is came a body at the night for the examination, and now she is murdered present in my hospital that if your please you came for her examination and or not I send this body for your seeing.—Yours, &c. SHAIK HOSSEIN KHAN.'

After the Public Works', the Postal Department is perhaps the best abused in India; though, when the class of material the heads of this department have to work with is taken into consideration, the results are rather satis-

factory than otherwise. What amount of intelligent work could, for instance, be extracted from a Deputy Postmaster who was guilty of issuing such a notice as this?

'To be raffled to the highest rattler. A Bay Waler Cape horse, hight was never known a bit, but of age a little as being outside of two years and inside of three years. He has been ridden as a charger in many cases. The rider departs with him as he is appointed Postmaster and is of no use to him—there is no work—to be thrown for by the rattling of three dices and the highest rattler to carry away the charger. Re. 1 per chance, the horse is a somewhat spirited animal.'

Natives sometimes rush into print, and endeavour to call attention to, and remedy, supposed abuses. The following appalling narrative, with the regulation moral attached, appeared in a daily paper:

'Will you please allow me to bring out a shuddering occurrence to light as a warning to the public through the medium of your valuable journal. When Smith my friend, a B. N. Doctor, took a walk yesterday at sunfall through a smiling plain, oh! both of us were shocked a good deal by a horrible spectacle of a big buffalo's dragging with a great speed, a girl of ten years old having a spaddle in her hand, with its right horn penetrated through her tightly knotted lock of hairs, pursued by a shouting crowd of people. The two of us and one Shaik, a head constable, who went with us, tried our best to give her our possible aid, but did not succeed. When the pitiless animal gored her through the tress, it seems she was as country girls usually do, weeding grass with the instrument. My heart has stopped its beating, when I unexpectedly saw her out of its horn, without the intermediation of any human being and at her narrow escape from a gloomy death. The group of men and women found to their great astonishment neither wounds nor injuries on her both extremities. The benefit that I could mention out of the above terrible scene is a warning to the poorer community, especially to the countrymen who generally permit their sons and daughters to go out on such a doing, not to allow longer hairs to grow on their heads.'

Another—an indignant orthodox Hindu—writes:

'Sir—I am old fashioned native—not one of your brandy and soda enlightened gentlemen with knickerbockers and yellow kid gloves, but a regular old and respectable sort of a chap with a regulation turband that has come down from the days of my greatest grandfather and before him too. The gods rest their souls unfortunate devils to be the projectors of such rascals as the nowaday natives with their low blackguard aping tricks. I'm very much mortied and I can tell why too. This morning about 5 or 5.30 when I was returning after performing my morning ablutions, I saw the son of a most respectable native citizen, now gathered with his father in another land, riding on pony. Now the mere fact, to quote legal phrase, of riding is nothing at all, but this vagabond feller had long top boots with jockey spurs on, cut away coat, and turband tied like hat—low on forehead to hid marks—the beast. So far so bad: but on the animal approaching I saw smoke coming from the boy's mouth and then I beheld cheroot. Uppah! what can I say? We Hindus do smoke but only early in the morning for medicinal purposes, but for pleasure never—on my word and honour as a man shortly to be exposed in funeral pile and reduced to the winds. This boy, sir, is only a type of the blackguard generation springing up from the ruins of ancient Hindu houses, whose ancestors were faithful to their salt. A generation which will be most stiff-necked, and increase the jail population and give British Government plenty of trouble and anxiety of brains. The boy I refer to is in Missionary School. What is the use? Although heathen myself I'd rather see every native a Christian ten thousand times than make themselves culpable and foolish rascally and mischievous—a nuisance and a danger in short, and in conclusion a ever present trouble. Write, sir, on this subject till your hand aches, and help to reform by kicking every Hindu boy you see dressed like European and oblige.'

The love of display is a very common failing among native students. This is well illustrated by the absurd manner in which they use long, and sometimes obsolete, words in place of those of ordinary and every-day use. To such an extent is this sometimes carried, that it is very difficult to understand what the writer's meaning is. The following extract from comments on an English Reading-book for schools, is a fair sample, though something better might well have been expected from the writer, who is a B.A. and M.A. of the Calcutta University:

'The extreme stimulus of professional and friendly solicitation has led me to the journey of accomplished advantages to proceed with these elucidatory and critical comments; wherein no brisking has been thrown apart to introduce the *primâ facie* and useful matters to facilitate the literary pursuits of lily-like capacities. If the aimed point be embraced favourably by the public, all and all grateful aknowledgments will ride on the jumping border from the very bottom of my heart.'

Here is another sample:

'Sir—I am drawing few lines to your honour, hoping you'll have feelings of compassion on me. I am a Christian by birth, I want to prosecute my study in the Entrance Class, but it is a matter of great regret on my part that I am ill off, owing the last breath of my father, so my sole request to you is only for free admittance in your school, above all I am adding, that by hook or by crook I will add Rs. 10s. for attending the lobby.* I am earning my livelihood by teaching a few boys at Babu J. Khan's place, and he has traced me

* The examination corresponding, as near as possible, to the London matriculation is in India called the Entrance Examination, the fee for admission to which is ten rupees, equivalent to one pound sterling. Entrance is, however, far too common a word, and lobby is therefore substituted, regardless of the utter nonsense it thus makes of the sentence.

as an object of pity, by helping clothes, lodging and all the books requisite for serving the purposes of the University Examination. Being deficient in Sanscrit, I am obliged to take Bengali as second language. Everything depends on the choice of all in all. I have nothing further to add than this, and this I conclude, with indefinite number of thanks.'

As a rule, complaints from native subordinates are not pleasant things to receive, and certainly it is very seldom they afford so much amusement as this:

'Sir—I beg leave to inform your honor that Daroga is always having been quarrel from me, for which I have got by your kindness this sepoy for the use of the jail hospital so many days ago that he living near the house of Behari Lall, and now Daroga saying to this sepoy, you not wait a moment at this place and go a way, so, sir, I am wishing that he resides always near me, and Daroga is not wishes to this way, for if this man will be wait in the day or night or any another place, then I will not living at this place, for Daroga is quarrel by me, therefore I will report in your.'

It is rarely indeed that a Director of a Museum receives such assistance as is proposed in the following letter. It need hardly be added that the 'stones precious' turned out to be specimens of the commonest rocks:

'Sir—I shall be obliged if you kindly let me know if the Committee of the Museum gives anything in the shape of prize or Bonus if I give them some stones precious which I have prepared for my Lord Jesus Christ's work they are picked from Bengal Division and from up country. My object in preparing them is to give the nett proceeds entirely for the food of blind incapables.'

Applications for appointments are always more or less amusing; but owing to the absurd combination of words used, they often defeat the end the writer has in view. Such a description as, 'I am a young man rarely past twenty-five educated narrowly—such as you will easily ascertain from the very composition which is of my own make, and this is my own handwriting,' would necessarily compel one to pass over the candidate as ineligible. But for originality of idea and expression, the following certainly carries off the palm:

'Most Honored Sir—The supreme end which I desire in life is to see you happy, blessed and prosperous; the supremest end, that this may be attained through my instrumentality. It was said by one who never said a lie, that "it is more blessed to give than to receive." Hence if you, transient sir, give me an appointment on the Orissa Canal work, you will be more blessed than I who receive it, and then my utter desire in this world will be accomplished. I do not wish to sing my own praises, but I vouchsafe to aver that I am quite competent for any position which you may in your condescension see fit to bestow. Let me, framptuous sir, conclude by reiterating my assertion that it is for your sake only I make this application. I am a blessed framp. I am glad to say that you will be a more blessed framp if you do the blesseder action of giving.'

What a framp is, we are unable to inform our readers.

THE MONTH.

SCIENCE AND ARTS.

The terrible gale of October 14th, with its long list of casualties on land and sea, is to form the subject of a Report to be brought before the Meteorological Society. The President of that body has undertaken its compilation; and he publicly asks for information from those in the possession of notes made from observations at the time of the occurrence. Records from self-recording barometers and anemometers; notes of the force of the wind; particulars respecting the destruction of buildings; and opinions as to the relative destructiveness of this particular storm, as compared with others experienced in this country and North-west Europe generally, represent the chief items about which information is needed.

A fleet of twenty-three huge icebergs was lately observed sailing from northern latitudes along the coasts of Labrador and Newfoundland. One of these was estimated to be a quarter of a mile long, and to stand three hundred feet above the surface of the water. As the visible portion of an iceberg represents but a tenth of its submerged bulk, this mass must have been in reality very large indeed. The icebergs moved through the water at a speed estimated at about two miles an hour, and in a direction which would be likely to cross the track of transatlantic vessels.

King Kalakaua, of the Sandwich Islands, has at last completed his tour round the world, which has occupied about eight months. Starting from San Francisco, His Majesty first visited China and Japan. After passing overland across India, he travelled *vid* Suez to Cairo and the Pyramids. Naples, Rome, Pompeii, were next visited. Then came Brussels, Berlin, Paris, &c. Next he proceeded to London, Edinburgh, Glasgow, finally taking passage at Queenstown for New York. It would be interesting to know what the king thought of all he saw.

The German schooner *Phœnix* reports the appearance of a new island in the Pacific, apparently of volcanic origin. It appeared to measure about one square mile in extent. H.M. ship *Kingfisher* and a United States' war-vessel have been despatched for the purpose of examining the island and reporting upon the matter.

The *Colonies and India* newspaper recently contained a very interesting article upon Sport in Australia, enumerating the various living things inhabiting the happy hunting-grounds found in the 'back country' of New South Wales or Queensland. To show the abundance and great variety of the game and vermin of New South Wales, the list of victims killed by one of the best shots in the colony is quoted, although the

time which it covers is not stated. Here figure kangaroos, wallabies, wallaroos, dingoes, wild-cats, bandicoots and rats, eagle-hawks and snakes. In all, just upon eight thousand head. It must be remembered that this does not represent mere wanton slaughter, but is the effort of one individual to keep down certain animals, which by their alarming increase are so inimical to the colonists. It has become necessary by act of parliament to declare constant war against these creatures; and any one who will devote his time to their slaughter is made a welcome guest everywhere. It is suggested that those at home who may be tired of the quieter sports found here, would do well to take their guns and thin the kangaroos and other creatures that are found in Australia in such alarming numbers.

Herr Raphael of Breslau is manufacturing mica masks for the use of workmen who are engaged in occupations where injury to eyesight or the face generally is likely to occur. Noxious vapours, heat, dust, flying fragments, can thus be guarded against; whilst from the transparent nature of the mask, the workman can easily see what he is about. If desired, the head, neck, and shoulders of the operator can have the additional protection of a sheet of cloth impregnated with fireproof material, attached to the mask. And in certain cases where dangerous chemicals are in use, the addition of a breathing tube is desirable, which finds its exit over one of the shoulders.

The poetical surroundings of 'the village blacksmith' and his harmonious anvil are threatened with a powerful rival, by the introduction from the United States of a new industry, namely, the manufacture of machine-made horse-shoes. A Company, whose premises face the Thames opposite Greenwich, have just opened their works, to supply the United Kingdom with these machine-made articles. The iron is rolled from scrap, coming from the rollers as a grooved bar, which is afterwards cut into lengths, punched with the necessary holes, and finally is bent by a machine into the horseshoe shape. It is calculated that there are in the United Kingdom about three million horses; in Europe generally more than thirty million; requiring annually a million and a half tons of shoes. So that if the new Company turn out good work, there are plenty of customers for their goods. It is said that the new shoe has met with the approval of some eminent authorities, and is already used by several tramway Companies.

It is a curious anomaly that colonial sugar after leaving the country of its production as a manufactured article, should, when it reaches our shores, require to be boiled, melted, and in fact manufactured over again, before it assumes the 'lump' form. There exists more than one reason why the refined article is not produced on the spot, and these are due to defects in the apparatus employed, which hitherto it has been found impossible to surmount. Mr F. A. Bonnefin, an experienced sugar-grower in Mauritius, has recently devised a system by which the sugar can be refined at the place where it is raised, and while the juice in the cane is fresh, and therefore in the best condition for treatment. The cane is first of all cut by vertical saws into slices, which, falling below the saw-frame, pass into a disintegrator, where they are rapidly reduced to pulp. By the action of rollers, this pulp is made to yield all its juice, which is then mixed with a certain proportion of lime. The viscid liquid is next caused to flow over a heated corrugated surface, where any solid impurities which it contains are made to fall into pockets or catch-pits. It is then subjected to filtration through a series of diaphragms of unspun cotton of the finest quality. The pure sirup thus obtained is next conducted to the ordinary vacuum pan, or to a special form of evaporator designed by Mr Bonnefin. The entire process only occupies one hour; while by the older methods from six to twelve hours elapsed before the cane took the form of white sugar. There are many other advantages connected with the new system, not the least of which is the avoidance of all chance of fermentation.

By the courtesy of Mr Edwin Streeter, we recently had the opportunity of seeing and handling what is supposed to be the most magnificent diamond ever discovered. It was found by Mr Porter Rhodes at his claim in the celebrated Kimberley Mine, South Africa. It is as yet uncut, and looks far more like a small lump of alum than the valuable gem it really is. Its weight is one hundred and fifty carats; and its owner, without mentioning the price he would demand for it, remarks that one hundred thousand pounds would not induce him to part with it. We understand that the most valuable diamonds are not, as generally thought, those which are perfectly colourless, but those which are known in the trade as 'blue diamonds.' The finest stone known of this description is valued at thirty thousand pounds. There is only one known specimen of a red diamond, a small but an expensive atom, for it is valued at eight hundred pounds. Additional interest will doubtless be manifested in Mr Rhodes' splendid prize when it comes to be 'cut.'

At a late meeting of the Balloon Society of Great Britain, Mr Woodbury read a most interesting paper on Balloon Photography. He first of all pointed out the extreme difficulty of procuring a photographic picture while the plate itself is in movement. With a steady camera, and an instantaneous shutter for opening and closing the lens in a fraction of a second, it is, by means of modern processes, comparatively easy to photograph an express train travelling at sixty miles an hour. Indeed, this has been done successfully more than once. Of course, there is no such thing as instantaneity, as even the quickest movement of any piece of apparatus must consume a certain amount of time. But in the case of the modern 'instantaneous shutter,' the movement would be so quick, that the express train in front would move forward very few inches during the same time, so that this movement would not be perceptible in the resulting

photograph. But if during exposure the camera itself be moved only the hundredth part of an inch, the effect upon the sensitive plate would be the same as if train and landscape had moved several yards, and a blur would be the result. Hence the difficulty of obtaining a photograph from a travelling balloon.

Notwithstanding these difficulties, Mr Woodbury anticipates that balloon photographs will be shortly produced, which will be of great value in many arts and sciences. Maps of villages and towns, with every detail, perhaps every inhabitant, plainly depicted, will represent one use of the balloon camera. In exploring expeditions, it will denote the course of rivers and streams, even though hills intervene. But in warfare, its value will perhaps be greater than in any other service. The outline of fortifications and other defences could be rapidly obtained, the photograph being subsequently placed in a lantern, where its enlarged image would be projected on a screen. In a few minutes, by well-known means, an enlarged copy three or four feet square, giving indisputable evidence of the strength or weakness of the opposing force, would be at the disposal of the commander and his officers.

Although electricity is now applied to so many and such varied purposes, it would hardly be supposed that the manufacturer of porcelain could find any use for it in the preparation of his plastic paste. But at two important French works, a *Gramme* machine is found of great use in separating from the paste certain ferruginous particles, which, left alone, would give the resulting ware a bad colour and spotted appearance. The paste in a very liquid state is made to pass through the poles of a powerful electro-magnet, which gathers its force from the Gramme machine already mentioned. The minute particles of iron are, of course, attracted by the magnet, and the paste passes on robbed of these encumbrances.

In Italy, a new industry has arisen in the production of condensed grape juice, after the pattern of condensed milk. The juice is evaporated in a vacuum pan until it assumes the appearance of toffee, and is reduced to one-tenth of its former bulk. By careful attention to temperature, it retains all its fruit-acid and grape-sugar, and also those mineral components which are believed to exercise great influence in forming the qualities of wine. Where difficulties of transport are found, this condensing process will be of very great value, though what the excise authorities may have to say in the matter will remain to be seen.

Mr Bourbon, of Perpignan, has invented a new form of engine for dealing death and destruction to the dreaded phylloxera. It is a blowpipe flame fed by means of bellows with a constant and regulated supply of petroleum. It is directed against the vine; and while it carbonises the outer bark, does not injure the woody tissues. Of course, in this charring process every form of insect pest is destroyed; and the inventor confidently asserts that if for two successive years the treatment be adopted at a particular season, vineyards which may have been given up as useless, will be restored to full bearing.

Some interesting and highly important statistics relative to Pasteur's method of inoculating sheep as a safeguard against splenic fever have recently been published. The number of animals treated was sixty-nine thousand, comprising one hundred and sixty flocks. Before vaccination, the losses by the disease amounted to no fewer than three thousand animals in the whole of the flock. During the vaccination process, the death-rate was reduced to one-third; and when the effects of vaccination were complete, the mortality from the disease fell to five.

During the recent gales, a large laburnum tree was uprooted in a field where some heifers were feeding. The rich foliage thus brought within their reach speedily attracted their attention, and they were soon busily engaged in devouring it. All, more or less, soon exhibited signs of poisoning, and some of them died. This result was not looked for, as it is known that the laburnum is a favourite food of hares and rabbits, and also that cattle have been known to feed upon it with impunity.

Sir John Lubbock has recently described some curious experiments bearing on the preference for certain colours exhibited by bees, and having reference to the important part which they play in removing pollen from one flower to another. He placed on a lawn small pieces of differently coloured paper, each paper having upon it drops of honey. By this means he found, after many observations, that the bees seemed to prefer blue to any other tint. This is a curious result, seeing that they have so much to do with the origin of flowers, blue flowers being more rarely found than those of any other colour. With reference to the longevity of ants, the same indefatigable observer remarks that he has some in his possession which have lived in confinement since the year 1874.

A tramway between Wisbeach and Upwell—a productive agricultural district—is about to be laid along the high-road by the Great Eastern Railway Company at a cost of twenty-five thousand pounds. Two or three bridges will, for the purposes of this line, have to be built over the Wisbeach Canal. This tramway represents an endeavour to solve the problem of sending farm produce to market expeditiously and cheaply, and the experiment will be watched with interest by all concerned. The line is to be worked by steam-engines of a light pattern, and will be available for both passengers and goods. The directors of the Company feel so sanguine of the financial success of their venture, that they have given notice of their intention to apply to parliament for powers to extend the same system to neighbouring parishes.

The Walton tramways, near Liverpool, have recently been the scene of some trials of different forms of steam-motors for street use, and they plainly show that light engines can be made both ornamental in appearance, and far more silent in their action than a tram-car drawn by horse-power. One of these motors consists of an arrangement combining engine and passenger car. It will carry twenty-two travellers, is free from heat, and silent in action. There is no doubt that in a short time both steam-motors and compressed-air engines will become common objects in our streets. Hitherto, the authorities have placed great restrictions on the use of steam, principally because horses are apt to take

fright at anything in the shape of 'puffing billy.' We are told that these experiments at Liverpool showed that most of the passing horses took no notice whatever of the intruders on their ground; though some certainly exhibited signs of fear. It might be useful, and we throw out the suggestion for what it is worth, to try and accustom horses to the sight of these motors before they come into active use. Military horses are soon accustomed to the sound of artillery, by constant practice; and there is no reason to suppose that their street brethren would not be equally tractable in the matter of steam.

An officer in one of the Revel fire brigades, whose name we are unable to ascertain, has invented a new form of fire extincteur which is said to be very efficient in practice. It consists of a powder which, coming into contact with burning material, will give off such dense fumes that the fire itself is speedily stifled. After stopping up all openings in a burning house, a few boxes of this powder are thrown into the burning mass; and the fire, it is said, is soon overwhelmed by the fumes from the composition. The powder is by no means cheap; but if it be effective, its expense will not be considered.

The Director of the Geological Survey in Ireland, Professor Hull, has regretfully called attention to the fact that the Land Act and its provisions have been drawn up without taking advantage of the great help in the way of land valuation which can be derived from a study of his science. He reminds us that the productiveness of the soil is materially influenced by the substratum. Thus, the best grazing lands are situated on a calcareous subsoil; while an underlying stratum of granite, schist, or sandstone, will afford a surface soil that must be used for other purposes. Again, a subsoil of clay or shale will require an amount of money spent upon it for drainage which would not occur in the case of limestone or a similar porous foundation. People who wish to purchase land in Ireland under the new conditions of tenure will no doubt profit by the hints thus thrown out, more especially as they can for a very small sum purchase a map of the country, in which the different geological substrata are clearly defined.

'Some time since,' says *The London Figaro*, 'it was announced that the Admiralty had purchased a large quantity of the new luminous paint, and the popular idea was that it was to be used for the coating of guard-ships, buoys, floating magazines, and the like; with the result that the darker the night the more plainly visible would the various floating objects become. We have not yet heard, however, that this notion has been acted upon, though it certainly seems practical enough in its intention.' Our contemporary, after suggesting that various parts of the coast might be daubed with the paint for the sake of warning ships, throws out the hint that if lighthouses were thus rendered luminous, they would become veritable pillars of flame night after night. The suggestion seems worthy of a trial.

Experiments have lately been made in Texas with a new material for paper-making. This is the common cactus or prickly-pear, which in many parts of Texas is a rank weed, very troublesome to settlers, and hitherto quite useless. Judge E. F. Hall, of Lareddo, has succeeded in convincing capitalists that the cactus is capable of producing good paper-making materials, and machinery for its manufacture is now being made. If it should prove successful, it will give a great impetus to the American paper-manufacture, the raw material being so cheap and plentiful.

OCCASIONAL NOTES.

'WHAT CAN WE DO WITH OUR YOUNGER SONS?'

This is a question of something like vital importance to a large section of the community. Under the operation of the laws of primogeniture and entail, the transmission of heritable, and more especially landed property, goes from father to child, preference being generally given to the eldest son or his heirs; and in this way the younger sons who are not in some business for themselves have necessarily to be content with such incomes as their parents are able to allot to them, these incomes in some cases being large, in others moderate, and in others next to nothing at all. In the last two cases, the younger son, if he is wise and his parents considerate, makes it his object, or ought to make it his object, to engage in some business or profession which may add to his income. But it does not happen that the younger sons of the well-born classes are all clever, any more than it happens in other classes; consequently, many expedients are resorted to with the view of enabling them to provide for themselves, or at least not to be a burden on their friends. One of the more favoured expedients of late has been—seeing that the practice of farming or cattle-rearing is unfortunately not yet fully recognised as a 'genteel occupation' at home—to ship off younger sons to follow these branches of business in some foreign country. When this has been done, the family somehow feel that they have done their duty by the young man at any-rate, and the further results must lie with himself.

A needed note of warning in this matter has come from California, in the form of a letter, which appears in the *Spectator* of November 26, and a summary of which will, we feel sure, interest many of our readers. The Editor of that paper says the letter is 'from a source for the perfect trustworthiness of which we can answer;' and the communication bears internal evidence that it is written by a gentleman who is, as he says himself, in the small number of the 'lucky' ones who have gone out to the far West.

Referring to the numerous failures of younger sons to push their way out there in California, the writer says: 'The great reason, I think, why so many have come to no good here, is from the way in which fathers often ship off their sons like so many head of cattle, telling them that there is pasture enough somewhere in the land, and they must only wander about till they find it. I fear that while wandering they are very likely to fall into some of those pits that I have seen ingulf many a hopeful young life.' He would not advise parents to send out any boy unless he were 'one of those creatures with a natural dislike to civilisation, never happy in society of any kind, but intensely fond of

"messing" about with animals and natural objects of all kinds;' in which case the rough life would not disgust him, and his knowledge of animals, &c., would stand him in good stead for finding work. 'But a boy with no such knowledge, and with only the experience of life that school or business has given him, will almost certainly be compelled to try one trade after another, falling down at each step, till at the end of some years, he goes home again in despair, and you find your boy something between a "happy Hampton welsher" and a music-hall waiter.'

In despite, however, of the failures which he sees around him, the writer still thinks there are openings in California for the 'younger olive-branches.' But he warns parents of the kind of company with whom their sons must almost necessarily associate, and by whom they are almost certain to be degraded and rendered vicious. 'You cannot,' he says, 'conceive how frightfully easy it is for a young fellow to drift downwards in this country. You send your boy out here to find "something;" and he finds, as I did, University-men working in mines up to their waists in water, waiting in restaurants, acting in third-rate theatrical parts—doing, in short, everything and anything that would put bread into their mouths.' He points out how much of this degradation may be avoided. 'You English fathers must not send an ordinary boy out here with your blessing and one hundred pounds, to sink and swim for himself. *He will certainly and surely come to grief.* Let him have some one's house to come to at the first start; or still better, come with him yourself; the voyage is nothing now, and you would make acquaintance with a magnificent country; try and find a home for him in some respectable family; and if possible, wait with him till he has found some work. Then, do not lose your "grip" on him; send him letters and papers constantly from home, make him feel he has you to fall back upon in any scrape or difficulty; and then, I venture to predict, your boy will succeed, and in a few years you will have a man to be proud of.'

THE NEST OF THE HARVEST MOUSE.

The harvest mouse is one of those little creatures which, though spread over the greater part of Europe, very few persons may have seen. This is partly accounted for by its shy habits, its smallness of body, and quickness of movement. This elegant little creature is light orange-brown on the upper parts, and white underneath, and is chiefly peculiar for the character of the nests which it builds, of which it has two kinds, one for summer and one for winter. The summer nest, in which it rears its young, is generally found suspended at some height from the ground between stalks of corn or reeds—three or four of the stalks being utilised as supports, and held in their places by the intertwining of their pedicles or stalk-leaves. The nest, when finished, is about the size of a cricket-ball, very neat and compact, the framework being formed of wheat leaves or such-like, and described by Gilbert White as 'most artificially platted.' The interstices are comfortably filled in with moss; while a small round opening, only large enough to admit one's little finger, is left in the top, to give access to the interior of the nest. Within the circumscribed space thus inclosed, as many as eight and nine young ones have been found at one time, and these so closely packed together that the rolling of the nest across a table could not dislodge them. There is little or no room for the mother inside; and how she manages to get so many little mouths filled from time to time is a wonder, as it seems impossible she can administer a teat to each. Here in this 'pendant bed and procreant cradle,' swaying to and fro as the summer wind stirs among the wheat, the little creatures guard and nourish their tiny offspring, till they are ready to go forth and forage for themselves.

So much for the summer nest; the winter nest in some important respects differs from this. The cutting down of the corn in autumn leading to the destruction of their summer residences, and giving the little inmates immediate notice to quit, they look about for a place where they may build a winter nest, to which in the cold season they may retreat. Professor H. Schlegel has just described these winter nests as he found them in a locality near Leyden in 1868. Here there was a ditch some quarter of a mile in length, and six paces in width, part of the border of which was grown over with reeds. A careful examination showed that these reeds actually contained about fifty nests of the harvest mouse. These winter nests he found to be composed of various mosses. They were attached to and between several stems of reeds, exactly like the nests of the reed-warbler, but more tapered in form, of from six inches to a foot in height, and from three to four inches in diameter. They showed no inlet, and were placed at the height of a foot over the water's level. The little creature when entering had to remove the upper part of the covering, which was less densely interwoven, and was concealed between the moss. It would seem evident that the building of these nests was a just calculation of being safe against the danger of drowning.

PRINTERS' MISTAKES.

A delicious piece of bamboozlement was served up to the readers of a provincial paper the other day, due in all probability to some wag of a sub-editor. The previous evening, the reporter for the paper had to attend a meeting at a Wesleyan Chapel, for the conversion of the Jews to Christianity; after which he reported an address given to a local Society on the Conversion of Sewage into Lime and Cement. In the compositor's hands, the manuscript got mixed up, and the printed report read as follows: 'The chairman, after the meeting had been opened with prayer, explained that the conversion of the Jews was one of the greatest works that could engage the attention of our sanitary authorities. Filtration was the most perfect method that could be adopted for purification; but a filter had its limits. There was a popular notion that the sewage contained a vast amount of wealth; but the sludge must be taken out of it for purposes of irrigation, as it otherwise choked the pores of the land; and they were a wandering race, spread over the whole face of the habitable globe. They were denied the inestimable blessings of Christianity, which might be counted by thousands of tons

per year being allowed to run to waste, when, by a judicious admixture of lime and clay, the benighted Hebrews who sat in darkness might easily be converted into lime and cement for building purposes; and if thus deodorised, after being first dried and burned in a kiln, this ancient race would once more take its proud position among the nations of the world. Subscriptions were earnestly solicited for the purpose, though he—the speaker—disclaimed any idea of making a profit out of the process; and in conclusion he urged increasing efforts in the good work, showing that thus deodorised, by a very novel process of evangelisation, in large tanks constructed for the purpose, the grateful Hebrews might flow over the land without injury to vegetation; while the expense of conversion, which was progressing as rapidly as the best friends of Christianity could wish, would be more than repaid by the sale of the phosphate of lime and valuable cement for building purposes.'

KINDNESS TO ANIMALS.

We have pleasure in drawing renewed attention to a most interesting monthly publication, called *The Animal World* (price 2d.), published by Partridge & Co., London, for the Royal Society for the Prevention of Cruelty to Animals. The publication referred to has been in existence for over twelve years, and its chief object is to teach humanity and kindness to animals, and to encourage the study of their habits and natures, so as the better to appreciate and admire the remarkable intelligence and docility which frequently distinguish them. The number before us for December 1st is what the editor calls 'a dog-number'—that is, it is mainly devoted to communications that narrate interesting anecdotes of canine sagacity and thoughtfulness, or plead for a more general improvement in the treatment dogs receive by being chained up for hours and days in back-courts, or sent long journeys by railway without any provision being made for having them supplied with water and food. The accounts here given of 'Railway Jack,' the London, Brighton, and South Coast Railway Dog, and of 'Brail,' a fire-preventing dog, are such as to awaken in the reader's mind a deeper sympathy for our dumb four-footed friends, who, denied by nature the gift of speech, have yet such resources of intelligence at their power as to be able to make known their wants, desires, and affections, even without the more luminous medium of words. It is with the utmost pleasure and confidence that we recommend this beautifully illustrated 'Advocate of Humanity' to our readers, and especially to our young readers.

'GOOD ADVICE TO SEAMEN.'

This little publication, of which the above is the title, is written by 'An Old Sailor' (Dundee: John Leng & Co.), and is evidently well adapted to secure the object of the author, which is to encourage among seamen 'a spirit of independence, self-reliance, and manliness.' In the distribution of his 'advice,' he does not omit the employers of the sailors or their officers, reminding the latter that the discipline and good conduct of the crew very much depend upon the example which their superiors set them. Practical instructions are also given to sailors in regard to their principal duties; the dietary arrangements on board ship are discussed; sailors' grievances pointed out, and hints given for the remedy of them. They are specially warned against the 'crimps' and other land-sharks that lie in wait for them in the home-ports, to fleece them of their hard-earned wages. The Board of Trade has taken up arms against the whole class of 'crimps'—that is, men who, by making advances to the sailors upon the security of their wages, swindle them out of the most of their money; and according to our author, the happy result has been, in Dundee at least, that the crimp has been almost, if not quite driven out of the field. The author, who in the course of his little book recommends to sailors the use of oil at sea in a storm, has here given much valuable advice and many useful suggestions to sailors and those connected with them; and the booklet can scarcely fail to advance both the material and moral welfare of those who lay its teachings to heart.

WILD BEASTS AND SNAKES IN INDIA.

It is with somewhat more than ordinary interest that we have for some years past awaited the annual records setting forth the fearful ravages wrought by tigers and other wild animals, and by snakes, throughout our Indian empire. From a brief notice which appears in the columns of a contemporary, we now learn that there has been a steady *decrease*, from 1876 to 1880, in the total number of wild animals destroyed throughout Hindustan, coupled, however, with a proportionate *increase* in the number of persons killed by wild animals and snakes. Thus, whereas in the year first named there were destroyed in Hindustan no fewer than twenty-three thousand four hundred and fifty-nine wild beasts, in 1880 the figures diminished to fourteen thousand eight hundred and eighty-six; but, during this same period, the number of human beings who have lost their lives has mounted up from nineteen thousand two hundred and seventy-two, to twenty-one thousand nine hundred and ninety! One satisfactory feature observable in the present annual returns is that relating to the great increase in the number of snakes destroyed in the Bombay Presidency alone. Of course, it must be a matter of impossibility to suggest an antidote for the mortal injuries inflicted by a wild beast such as the tiger; but there would seem to be a good field now presented for the further prosecution of the experiments already made by Dr de Lacerda in connection with a specific for snake-bite.

'CASTING BREAD ON THE WATERS.'

It is always pleasant to put on record instances of heroic self-sacrifice, and it is equally pleasant to put on record instances of gratitude on the part of those for whom such self-sacrifices were made. A correspondent sends us two advertisements which show in a remarkable manner how 'bread cast upon the waters' may return after many days. The first notification intimates that, 'If Benjamin or Andrew Binkin, who left London for the East Indies in 1839, and who saved the life of a lady passenger from being drowned, will apply to

——, he will hear of something to his advantage. If dead, his children will be entitled.' The second is even more definite: 'If Joseph Pearce, carpenter, formerly of Stroud, and who was at the rebuilding of Daylesford Church in 1860, will apply to ——, he will hear of a large property in land and cash left him by a lady whose life he saved at the risk of his own in 1846.' While the good we do should not be regulated by the mere prospect of reward that may follow; yet, when a good deed has been disinterestedly done, it is a pleasure to notice that the recipient has been grateful.

WHAT THE YEARS BRING.

Two sunny-haired and clear-voiced children stood
  Among the flowers all careless; sunshine played
About their golden heads; and in the wood
  The birds rejoiced, and pleasant music made.
Ah! Life's fresh morning is so gay and sweet,
They cared not for the flowers beneath their feet.

A youth and maiden in the summer noon
  Wandered, and looked into each other's eyes,
And thought that Love was such a priceless boon,
  That having it, no little cloud could rise
Upon their sky—so radiant, when we love,
Grows earth around us, and the sky above.

Two happy lives, close welded into one;
  Bright children playing round them, and the light
Of Love and Home, like to the blessed sun
  Shining about them, while the calm years' flight
Brings only happiness, for Home and Love
Are dear as heaven and the saints above.

One widowed heart, whose life-pulse beats alone;
  Children all fatherless, and hope all fled:
What matter that she makes such bitter moan,
  Or shrouds in fruitless woe her golden head?
The world goes by, all careless of her woe;
Cold world, which ever treats our sorrows so!

A grave, where tender maidens come to weep,
  Bringing fresh garlands, when the old are dead.
What matters it? Their love breaks not the sleep
  Of the quiet ears which hear no more their tread.
Such are our little lives; but heaven is ours,
When faded are our hopes, our loves and flowers.

J. H.

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OUR JUBILEE YEAR,

1882.

IN the Monthly Part to be issued at the end of January 1882, will appear an address to our readers, entitled,

REMINISCENCES OF A LONG AND BUSY LIFE:

From the pen of Dr W. CHAMBERS, the Founder of

CHAMBERS'S JOURNAL.

END OF EIGHTEENTH VOLUME.

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